CLAIMS

1. (currently amended) A computer implemented method for presenting lighting characteristics associated with a display object in real-time during a video presentation through a single graphics processing unit, comprising:

(a) executing a ray tracing algorithm through a stream processor, the executing including;

(i) generating a ray associated with a point on the display object toward a light source using a biased approximator for determining a direct illumination component toward a light source; ~~and~~

(b) determining an approximation of a transfer function component using at least one basis function, the determining identifies whether the ray is within a view plane of the light source, the approximation of the transfer function component producing lighting characteristics data is stored along with texture map data, the approximation corresponding to a center point of a texel associated with a corresponding point on the display object, and storing coefficients resulting from the approximation, the coefficients represent surface reflectance, and wherein conducting the approximation corresponding to the center point of the texel eliminates calculation of the transfer function component at corners of triangles, thus avoiding interpolation of triangle vertices;

(c) multiplying the coefficients that are stored by the direct illumination component to define approximated lighting for the point on the display object; and

(d) rendering the approximated lighting for the point of the display object on a screen.

2. (Currently amended) The computer implemented method of claim 1, wherein the texel is defined as one of multiple texels correspond to one pixel for minification, or one

texel corresponds to multiple pixels for magnification. ~~the method operation of determining an approximation of a transfer function component using at least one basis function includes,~~

~~determining whether the ray is within a view plane of a light source.~~

3. (Currently amended) The computer implemented method of claim 1 [[2]], repeating operations (a) - (d) for multiple points of the display object so as to render the display object over one or more frames of a series of video frames. ~~wherein if the ray is within the view plane of the light source, then the method includes,~~

~~determining a direct illumination component of the lighting characteristic~~.

4. (Currently amended) The computer implemented method of claim 1 [[2]], wherein if the ray is not within the view plane of the light source, then the method includes,

determining a self interreflection component of the lighting characteristic.

5. (Currently amended) The computer implemented method of claim 1, further comprising:

repeating the determining of an approximation of a transfer function component for a series of basis functions ~~without accessing a pre-calculated geometry associated with the object~~; and

the rendering the display object using the approximation of the transfer function component for the series of basis functions.

6.-22. (Cancelled)

23. (Currently amended) A computer implemented method for calculating an approximation to a transfer function defined by at least one basis function for rendering shading characteristics of an object in real time during a video presentation, comprising:

(a) identifying a point on the object;

(b) calculating a lighting function for the point, the calculating including;

(i) applying a ray tracing algorithm through a stream processor ~~without accessing pre-calculated geometry associated with the object~~;

(ii) determining a direct illumination transfer function through a biased approximator for the point in real time; and

(iii) determining a secondary lighting contribution in real time during the video presnetation, the secondary lighting contribution identified through a series of multiply and add operations ~~applied to data resulting from the ray tracing algorithm~~, resulting in coefficients that represent surface reflectance; and

(iv) combining the coefficients that represent the surface reflectance with the direct illumination transfer function to render the shading characteristics of the object in real time for display on a screen, wherein each operation is performed within a single graphics processing chip.

24. (Currently amended) The computer implemented method of claim 23, wherein the secondary lighting contribution is determined from a center point of a texel without processing corners of triangles, thus avoiding interpolation of triangle vertices ~~wherein the multiply and add operations are performed by the stream processor without calculating the lighting function at triangle corners~~.

25. (Cancel)

26. (Currently amended) The computer implemented method of claim 23, further comprising:

repeating the identifying of (a) and the calculating of (b) for multiple points on the object.

27. (Currently amended) The computer implemented method of claim 26, wherein the method operation of repeating the identifying of (a) and the calculating of (b) for multiple points on the object includes,

(c) performing the calculating for a portion of the multiple points during a first frame of image data, and

(d) performing the calculation for a remainder of the multiple points during a next frame of image data.

28.-32. (Cancel)

33. (Currently amended) A computer readable medium embodying ~~having~~ program instructions for calculating an approximation to a transfer function defined by at least one basis function for rendering shading characteristics of an object in real time during a video presentation, comprising:

program instruction for identifying a point on the object;

program instruction for calculating a lighting function for the point, the program instruction for calculating including;

program instruction for applying a ray tracing algorithm through a stream processor ~~without accessing pre-calculated geometry associated with the object~~;

program instruction for determining a direct illumination transfer function through a biased approximator for the point in real time; and

program instruction for determining a secondary lighting contribution in real time, the secondary lighting contribution identified through a series of multiply and add operations ~~applied to data resulting from the ray tracing algorithm~~, resulting in coefficients that represent surface reflectance; and

program instruction for combining the coefficients that represent the surface reflectance with the direct illumination transfer function to render the shading characteristics of the object in real time for display a screen, wherein each of the programming instructions are executed through a single graphics processing chip.

34. (original) The computer readable medium of claim 33, further comprising:

program instruction for repeating the identifying and the calculating for multiple points on the object.

35. (original) The computer readable medium of claim 34, wherein the method operation of repeating the identifying and the calculating for multiple points on the object includes,

program instruction for performing the calculating for a portion of the multiple points during a first frame of image data, and

program instruction for performing the calculation for a remainder of the multiple points during a next frame of image data.

36.-38. (Cancel)

39. (Currently amended) A computing device, comprising:

(a) a graphics processing unit (GPU) capable of determining lighting characteristics for a point of an object in real time during a video presentation ~~without accessing pre-calculated geometry associated with the object~~, the lighting characteristics defined through a basis function, the GPU including a stream processor configured to split a stream of data associated with the lighting characteristics into multiple simultaneous operations for determining the lighting characteristics, the determining including;

(i) applying a ray tracing algorithm through the stream processor;

(ii) determining a direct illumination transfer function through a biased approximator for the point in real time; and

(iii) determining a secondary lighting contribution in real time, the secondary lighting contribution identified through a series of multiply and add operations, resulting in coefficients that represent surface reflectance; and

(iv) combining the coefficients that represent the surface reflectance with the direct illumination transfer function to render the lighting characteristics of the point of the object; and

(b) a display screen in communication with the GPU, the display screen configured to present image data representing the object.

40. (Currently amended) The computing device of claim 39, wherein the computing device is part of a video game console.

41. (Cancel)

42. (original) The computing device of claim 39, wherein the stream processor is a programmable hardware unit capable of executing code that is replicated multiple times.

43. (Cancel)

44. (Currently amended) The computing device of claim 39 ~~43~~, wherein the ray tracing algorithm determines the [[a]] direct illumination transfer function ~~lighting characteristic~~ in real time for multiple points on the object and the multiply and add operation determine the [[a]] secondary lighting contribution ~~characteristic~~ in real time without calculating the lighting characteristics ~~function~~ at triangle corners.

45. (original) The computing device of claim 39, wherein the GPU is further configured to render the object through a process involving linear interpolation, such that the lighting characteristics are applied to the rendered object.

46. (original) The computing device of claim 39, wherein the basis function is one of a wavelet and a spherical basis function.